

SK6021

Ultra Low Current Consumption 400mA CMOS LDO

General Description

The SK6021 is a high accuracy, low noise, high speed CMOS Linear regulator with low power consumption and low dropout voltage, which provide large output currents even when the difference of the input-output voltage is small. The devices offer a new level of cost effective performance in cellular phones, laptop and notebook computers, and other portable devices.

The current limiter's fold-back circuit also operates as a short circuit protection and an output current limiter at the output pin.

The SK6021 regulators are available in standard SOT23-3, SOT23-5, DFN1x1-4 and SOT89-3 packages.

Standard products are Pb-free and Halogen-free.

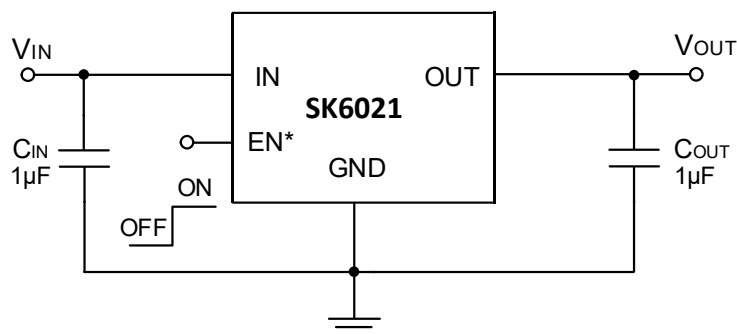
Features

- Input voltage: 1.5V~6.5V
- Output range: 1.2V~5.0V
- Maximum output current: 400mA @ $V_{OUT}=3.3V$
- PSRR: 60dB @ 1KHz
- Dropout voltage: 180mV @ $I_{OUT}=100mA$
- Quiescent current: 0.5 μA Typ.
- Shut-down current: <1 μA
- Recommend capacitor: 1 μF
- Built-in Short-Circuit Protection, Current Limiter

Applications

- Radio control systems
- Cellphones, radiophone, digital cameras
- Bluetooth, wireless handsets
- Others portable consumer equipments

Typical Application Circuit



Note*: For SOT23-5L and DFN1X1-4L package only.

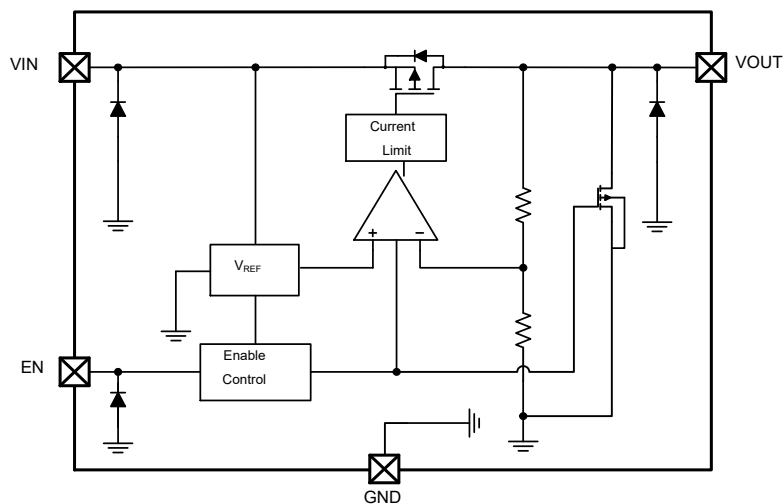
Ordering Information

Part No.	Package	Temperature	Tape & Reel
SK6021S3-XX	SOT23-3L	-40°C ~ +85°C	3000/REEL
SK6021S5-XX	SOT23-5L	-40°C ~ +85°C	3000/REEL
SK6021D4-XX	DFN1x1-4L	-40°C ~ +85°C	10000/REEL
SK6021T3B-XX	SOT89-3L	-40°C ~ +85°C	1000/REEL

Note: XX indicates 1.2V~5.0V by 0.1V step. For example, 28 means product outputs 2.8V

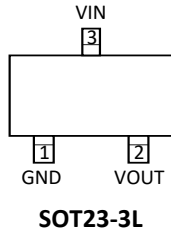
SK6021 devices are Pb-free and RoHS compliant

Block Diagram



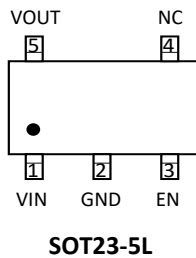
Pin Configuration

TOP VIEW



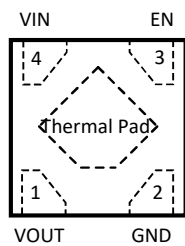
SK6021S3 (SOT23-3L)

PIN NO.	PIN NAME	FUNCTION
1	GND	GND pin
2	VOUT	Output voltage pin
3	VIN	Input voltage pin



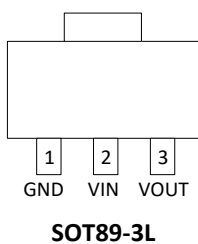
SK6021S5 (SOT23-5L)

PIN NO	PIN NAME	FUNCTION
1	VIN	Input
2	GND	Ground
3	EN	Enable(Active high, not floating)
4	NC	Not connected
5	VOUT	Output



SK6021D4 (DFN1x1-4L)

PIN NO	PIN NAME	FUNCTION
1	VOUT	Output
2	GND	Ground
3	EN	Enable(Active high, not floating)
4	VIN	Input
-	Thermal Pad	Thermal pad, connect to GND



SK6021T3B (SOT89-3L)

PIN NO.	PIN NAME	FUNCTION
1	GND	GND pin
2	VIN	Input voltage pin
3	VOUT	Output voltage pin

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Input Voltage	V_{IN}	-0.3V ~ 8V	V
Maximum Output Current	I_{OUT}	400	mA
Ambient Temperature	T_A	-40 ~ +85	°C
Storage Temperature	T_{STG}	-50 ~ +150	°C
Package Lead Soldering Temperature	T_{SOLDER}	260°C, 10s	

Note: These are stress ratings only. Stresses exceeding the range specified under “Absolute Maximum Ratings” may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

Thermal Information

Symbol	Parameter	Package	Max.	Unit
θ_{JA}	Thermal Resistance (Junction to Ambient) (Assume no ambient airflow, no heat sink)	SOT23-3	260	°C/W
		SOT23-5	260	
		DFN1x1-4	300	
		SOT89	200	
P_D	Power Dissipation	SOT23-3	0.40	W
		SOT23-5	0.40	
		DFN1x1-4	0.40	
		SOT89	0.50	

Note: P_D is measured at $T_a = 25^\circ\text{C}$

Electrical Characteristics

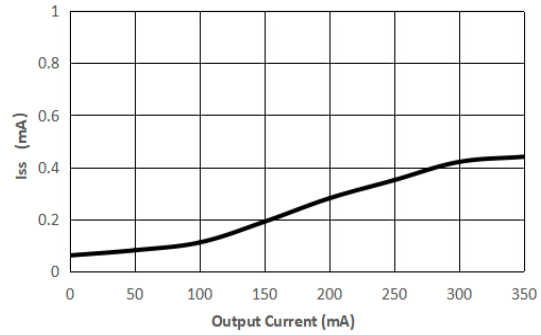
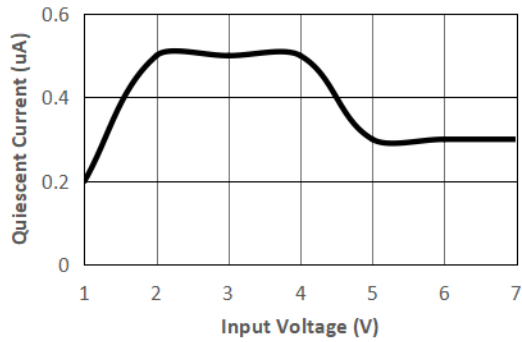
The following specifications apply for $V_{OUT}=3.3\text{V}$, $T_A=25^\circ\text{C}$, unless specified otherwise

SYMBOL	ITEMS	CONDITIONS	MIN	TYP	MAX	UNIT
V_{IN}	Input Voltage		1.5	--	6.5	V
V_{OUT}	Output Range	$V_{OUT} \leq 2.5\text{V}$, $I_{OUT}=1\text{mA}$	$V_{OUT}-50$	V_{OUT}	$V_{OUT}+50$	mV
		$2.5\text{V} \leq V_{OUT} \leq 5\text{V}$, $I_{OUT}=1\text{mA}$	-2	V_{OUT}	2	%
I_Q	Quiescent Current	$V_{OUT}=3.3\text{V}$, $I_{OUT}=0$	--	0.5	--	μA
I_{LIMIT}	Current Limit	$V_{IN}=V_{EN}=4.5\text{V}$	--	400	--	mA
V_{DROP}	Dropout Voltage	$V_{OUT}=3.3\text{V}$, $I_{OUT}=100\text{mA}$	--	180	--	mV
		$V_{OUT}=3.3\text{V}$, $I_{OUT}=200\text{mA}$	--	400	--	
ΔV_{LINE}	Line Regulation	$V_{IN}=2.7 \sim 5.5\text{V}$, $I_{OUT}=1\text{mA}$	--	0.01	0.15	%/V
ΔV_{LOAD}	Load Regulation	$V_{OUT}=3.3\text{V}$, $I_{OUT}=1 \sim 300\text{mA}$	--	40	--	mV
I_{SHORT}	Short Current	$V_{EN}=V_{IN}$, V_{OUT} Short to GND with 1Ω	--	35	--	mA
I_{SHDN}	Shut-down Current	$V_{EN}=0\text{V}$	--	--	1	μA
PSRR	Power Supply Rejection Rate	$V_{IN}=5V_{DC}+0.5V_{P-P}$ $F=1\text{KHz}$, $I_{OUT}=10\text{mA}$		60		dB
V_{ENH}	EN logic high voltage	$V_{IN}=5.5\text{V}$, $I_{OUT}=1\text{mA}$	1.2	--	V_{IN}	V
V_{ENL}	EN logic low voltage	$V_{IN}=5.5\text{V}$, $V_{OUT}=0\text{V}$	--	--	0.4	V
I_{EN}	EN Input Current	$V_{EN}=0$ to 5.5V	--	--	1	μA

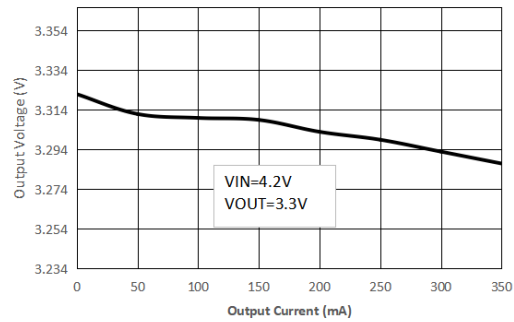
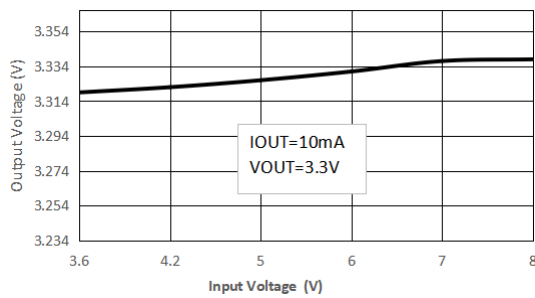
Typical Performance Characteristics

$C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, $V_{IN}=4.5V$, $V_{OUT}=3.3V$, SOT23-5, $T_A=25^\circ C$, Unless specified otherwise.

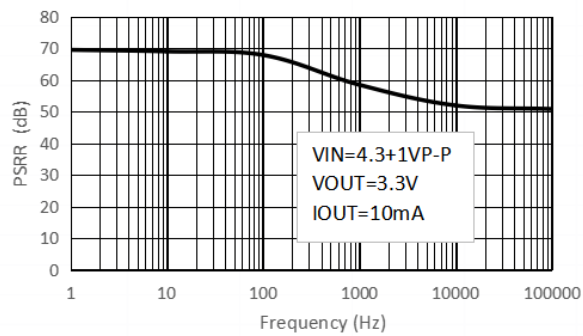
(1) Quiescent current vs Input voltage



(2) Output Voltage vs Input voltage

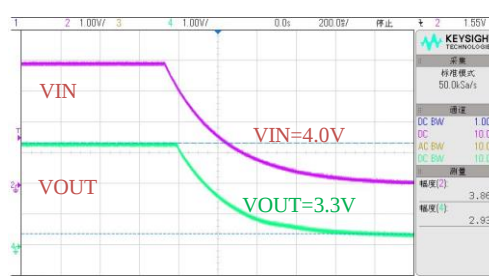
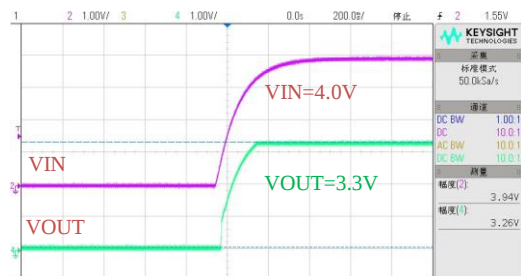


(3) PSRR vs Frequency

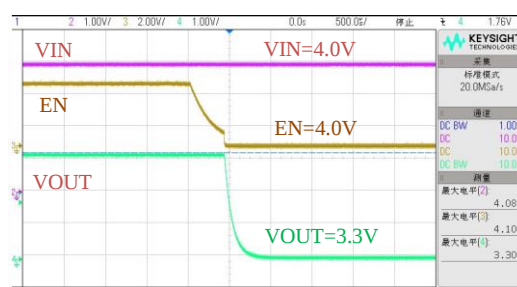
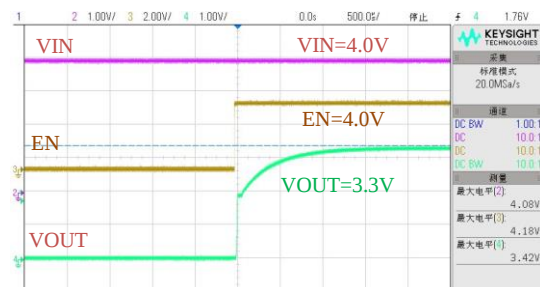


Typical Performance Characteristics (Continued)

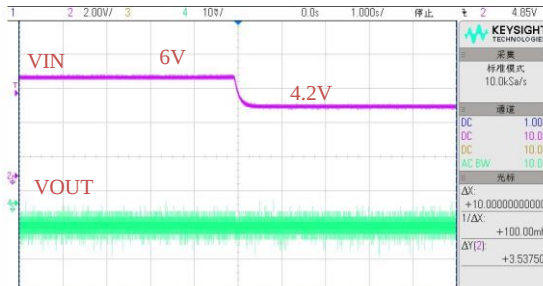
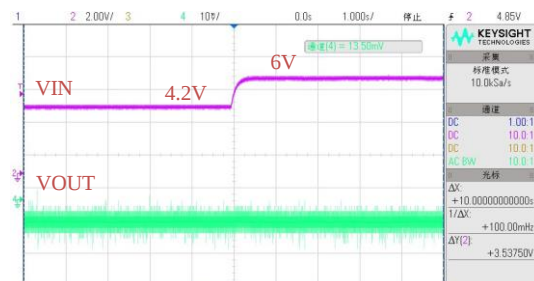
Power ON / OFF



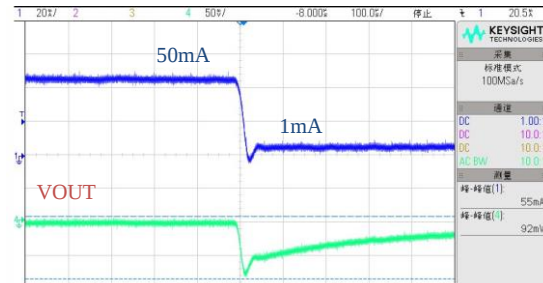
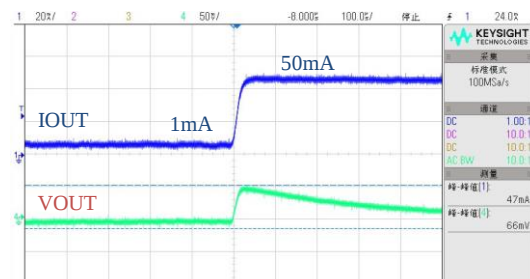
EN ON/OFF



Line Transient



Load Transient



Application Information

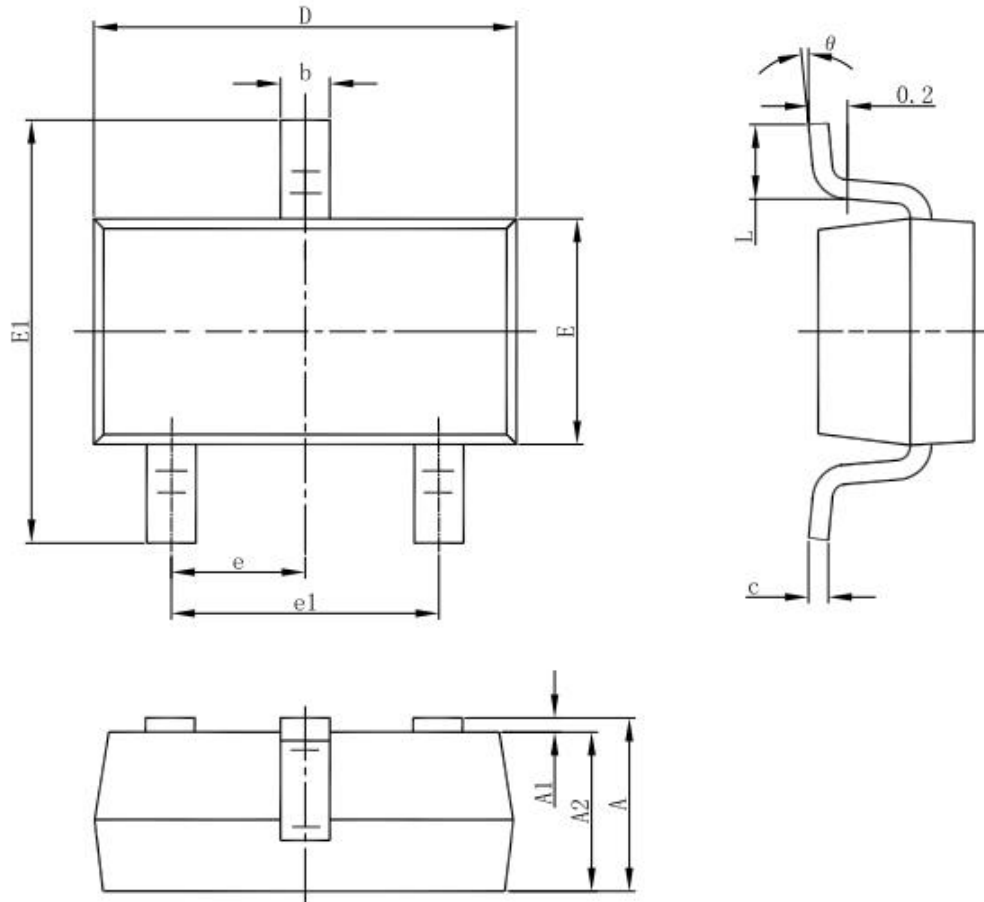
In general, all the capacitors need to be low leakage. Any leakage the capacitors have will reduce efficiency, increase the quiescent current.

A recent trend in the design of portable devices has been to use ceramic capacitors to filter DC-DC converter inputs. Ceramic capacitors are often chosen because of their small size, low equivalent series resistance (ESR) and high RMS current capability. Also, recently, designers have been looking to ceramic capacitors due to shortages of tantalum capacitors. Unfortunately, using ceramic capacitors for input filtering can cause problems. Applying a voltage step to a ceramic capacitor causes a large current surge that stores energy in the inductance of the power leads. A large voltage spike is created when the stored energy is transferred from these inductance into the ceramic capacitor. These voltage spikes can easily be twice the amplitude of the input voltage step.

Many types of capacitors can be used for input by-pass, however, caution must be exercised when using multi layer ceramic capacitors (MLCC). Because of the self-resonant be generated under some start-up conditions, such as connecting the LDO input to a live power source.

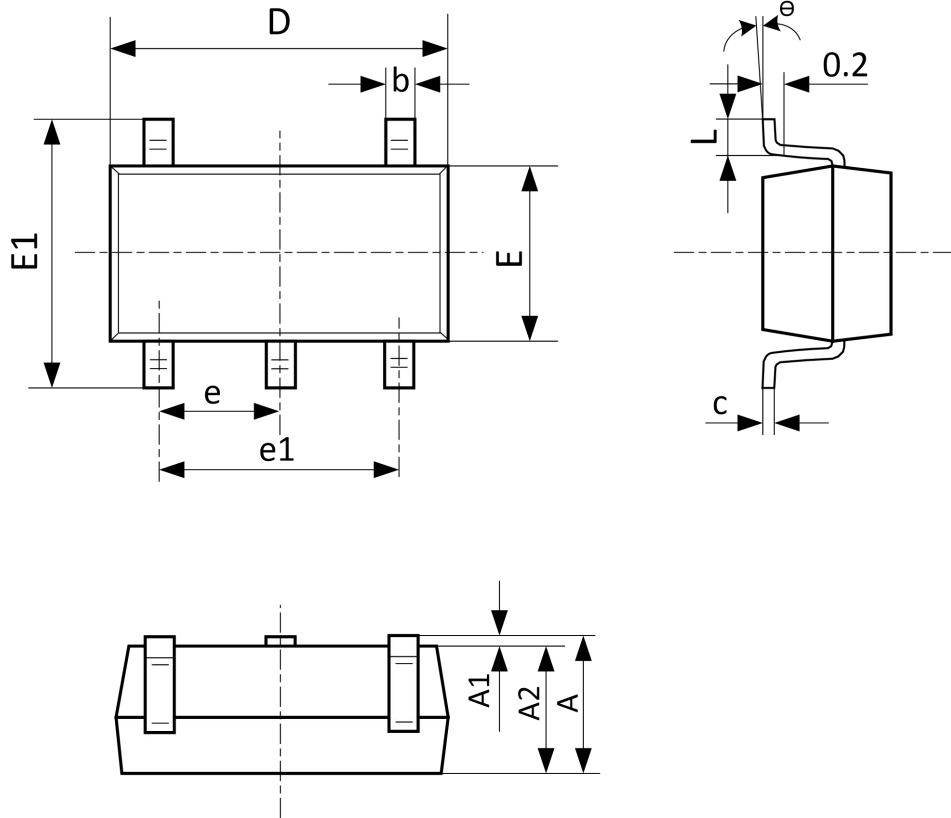
The LDO also requires an output capacitor for loop stability. Connect a 1uF tantalum capacitor from OUT to GND close to the pins. For improved transient response, this output capacitor may be ceramic.

Package Dimensions: SOT23-3L



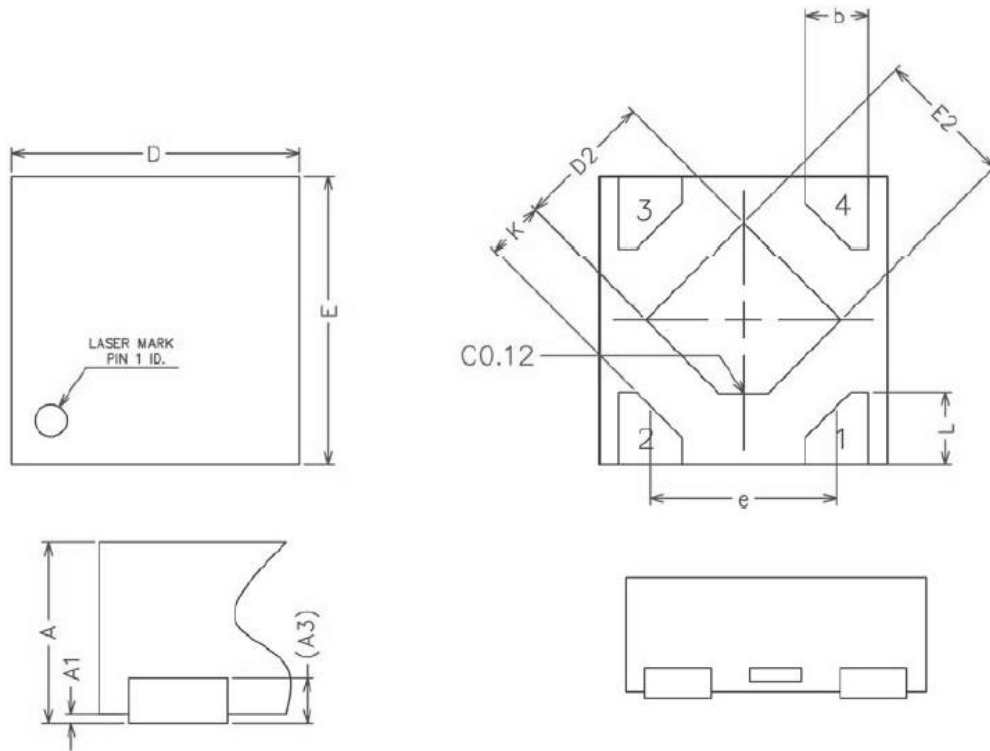
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

Package Dimensions: SOT23-5L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°C	8°C	0°C	8°C

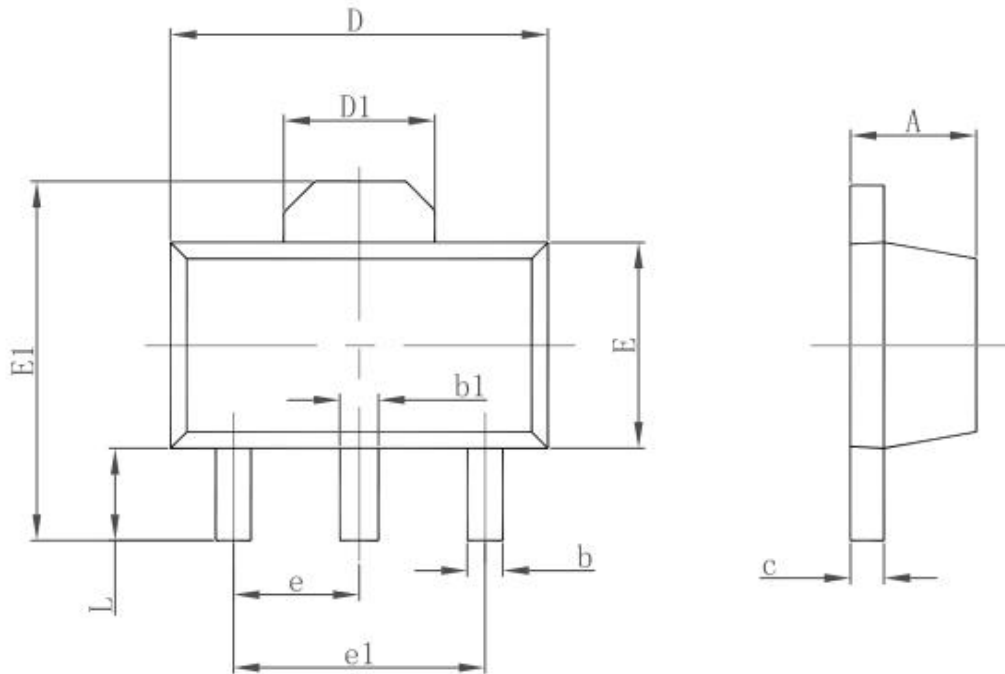
Package Dimensions: DFN1X1-4L



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.34	0.37	0.40
A1	0.00	0.02	0.05
A3	0.100REF		
b	0.17	0.22	0.27
D	0.95	1.00	1.05
E	0.95	1.00	1.05
D2	0.43	0.48	0.53
E2	0.43	0.48	0.53
L	0.20	0.25	0.30
e	—	0.65	—
K	0.15	—	—

Package Dimensions: SOT89-3L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF.		0.061 REF.	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP.		0.060 TYP.	
e1	3.000 TYP.		0.118 TYP.	
L	0.900	1.200	0.035	0.047